FACTS about pesticides

Ontario
Ministry of the Environment

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Minister

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CALCULATIONS FOR STRUCTURAL PEST CONTROL

Because label mixing directions are now in metric, a thorough understanding of this system is required. The following information should assist you in calculating the quantities of pesticides required for specific purposes.

Useful Facts

- A 1% concentration of a pesticide is equivalent to 10 grams of active ingredient per litre.
- One litre of water weighs 1 kg.

THE METRIC SYSTEM

Linear Measures (length)

10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1000 metres = 1 kilometre (km)

Square Measures (area)

100 m x 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measures

1000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid Measures

1000 millilitres (mL) = 1 litre (L)

Weight - Volume Equivalents (Water)

(1.00 kg) 1000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)

Weight Measures

1000 milligrams (mg) = 1 gram (g)
1000 g = 1 kilogram (kg)
1000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)

Dry - Liquid Equivalents

1 cm^3 = 1 mL
1 m^3 = 1000 L

METRIC EQUIVALENTS (approximate)

LENGTH

1 inch	=	2.54 cm = 25.4 mm
1 foot	=	0.30 m
1 yard	=	0.91 m
1 mile	=	1.61 km

AREA

1 square foot	=	0.09 m^2
1 square yard	=	0.84 m^2
1 acre	=	0.40 ha

VOLUME (dry)

1 cubic yard	=	0.76 m^3
1 bushel	=	36.37 L

VOLUME (liquid)

1 fluid ounce (Imp.)	=	28.41 mL
1 pint (Imp.)	=	0.57 L
1 gallon (Imp.)	=	4.55 L
1 gallon (U.S.)	=	3.79 L

WEIGHT

1 ounce	=	28.35 g
1 pound	=	453.6 g
1 ton	=	0.91 tonne

PRESSURE

1 pound per square inch	=	6.90 kPa

CONVERSION TABLES - METRIC TO IMPERIAL
(approximate)

Length

1 millimetre (mm)	=	0.04 inch
1 centimetre (cm)	=	0.40 inch
1 metre (m)	=	39.40 inches
1 metre (m)	=	3.28 feet
1 metre (m)	=	1.09 yards
1 kilometre	=	0.62 mile

Volume (liquid)

1 millilitre (mL)	=	0.035 fluid ounce
1 litre (L)	=	1.76 pints
1 litre (L)	=	0.88 quart
1 litre (L)	=	0.22 gallon (Imperial)
1 litre (L)	=	0.26 gallon (U.S.)

Weight

1 gram (g)	=	0.035 ounce
1 kilogram (kg)	=	2.21 pounds
1 tonne (t)	=	2205 pounds

Pressure

1 kilopascal (kPa)	=	0.15 pounds/square inch

Proportion

1 litre per hectare	=	14.24 fluid ounces per acre
1 kilogram per square centimetre	=	14.23 pounds per square inch

Area

1 square centimetre (cm^2)	=	0.16 square inch
1 square metre (m^2)	=	10.77 square feet
1 square metre (m^2)	=	1.20 square yards
1 square kilometre (km^2)	=	0.39 square mile
1 hectare (ha)	=	107,636 square feet
1 hectare (ha)	=	2.5 acres

Volume (dry)

1 cubic centimetre (cm^3)	=	0.061 cubic inch
1 cubic metre (m^3)	=	1.31 cubic yards
1 cubic metre (m^3)	=	35.31 cubic feet

Speed

1 metre per second	=	3.28 feet per second
1 metre per second	=	2.24 miles per hour
1 kilometre per hour	=	0.62 mile per hour

Temperature

°F = (°C x 9/5) + 32
°C = (°F - 32) x 5/9

EXAMPLE A - Preparing a dilute spray from a liquid concentrate (EC - emulsifiable concentrate or S-solution)

FORMULA - $Q = \frac{S \times A}{C}$

Where Q = Quantity of concentrate required in the mixture
S = Percentage of active ingredient in the finished spray
A = Amount of spray to be prepared
C = Percent of active ingredient in the concentrate

QUESTION 1:

Prepare 9 litres of a 0.5% chlorpyrifos formulation from a concentrate of Chloryprifos 2E (containing 240 grams of chlorpyrifos per litre). How much chlorpyrifos 2E will you require?

Answer using $Q = \frac{S \times A}{C} = \frac{0.5\% \times 9\ L}{24\%} = 0.187\ L$

since 1 L = 1000 mL
therefore 0.187 L = 187 mL is needed

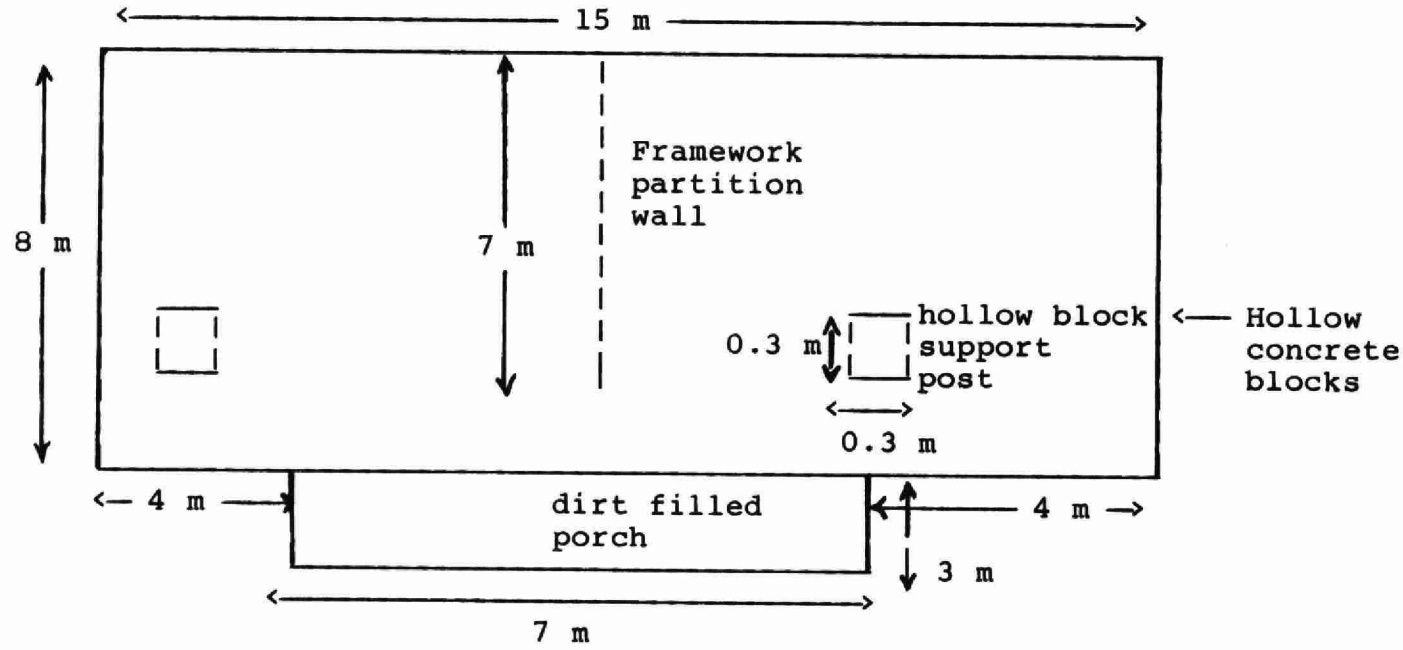
QUESTION 2:

Prepare 4.5 litres of a 2% malathion formulation from 50% Malathion EC. How much 50% malathion EC will you require?

Answer $Q = \frac{S \times A}{C} \quad \frac{2\% \times 4.5\ L}{50\%} = 0.18\ L = 180\ mL$

QUESTION 3:

You are required to treat an existing structure for termites. The basement floor plan is as follows:



The depth from grade to top of the footing is 2 metres.

a) Prepare 700 L of a 0.5% aldrin emulsion using an aldrin 40E concentrate (400 g/litre). How much EC will be needed to make 700 litres of 0.5% aldrin emulsion?

Answer

$$Q = \frac{S \times A}{C}$$

$$Q = \frac{0.5\% \times 700\ L}{40\%} = 8.75\ L$$

b) How much 0.5% aldrin emulsion will be required to treat the entire structure. Assume an active infestation and wall voids are to be treated. Rates of application are as follows:

1. Treatment of exterior foundation perimeter - 5 L/linear metre/25 cm of depth.
2. Treatment beneath slab along interior foundation wall - 7.5 L/linear metre.
3. Treatment along partition walls - 7.5 L/linear metre.
4. Treatment of wall voids 1.5 litres/0.5 linear metres.
5. Support posts 6 L/m^2 beneath slab and 7.5 $L/metre^2$ into void.
6. Unexcavated soil 7.5 L/linear metre.

Answer

1. Foundation - exterior perimeter
rate: 5 L/linear metre/25 cm of depth
total linear metres = 15 + 8 + 4 + 3 + 7 + 3 + 4 + 8
= 52 linear metres
at a rate of 5 L/linear metre

$5 \times 52 = 260$ L
the depth from grade to top of footing is 2 m and
rate of application is per 25 cm of depth
(1 m = 100 cm)
$260 \times \frac{200}{25} = \underline{2080 \text{ L}}$

2. Slab - interior perimeter of foundation wall
rate: 7.5 L/linear metre
total linear metres = 15 + 8 + 15 + 8 = 46 linear metres
at a rate of 7.5 L/linear metre

$7.5 \times 46 = \underline{345 \text{ L}}$

3. Partition wall - beneath slab
rate: 7.5 L/linear metre

$7 \times 7.5 = \underline{52.5 \text{ L}}$

4. Treatment of wall voids (from outside)
rate: 1.5 L/0.5 linear metres
total linear metres = 15 + 8 + 4 + 3 + 7 + 3 + 7 + 4 + 8
= 59 linear metres

$1.5 \times \frac{59}{0.5} = \underline{177 \text{ L}}$

5. (a) Support posts
rate: 6 L/m^2 around post
$0.3 \times 0.3 = 0.09$ m^2
$6 \times 0.09 = 0.54$ L
$2 \times 0.54 = \underline{1.08 \text{ L}}$

(b) Post voids
rate: 7.5 L/meter ^{2}
$0.09 \times 7.5 = 0.68$
$2 \times 0.68 = \underline{1.36 \text{ L}}$

6. Unexcavated soil
rate: 7.5 L/linear metre
total linear metre = 3 + 7 + 3 + 7 = 20 linear metre

$7.5 \times 20 = \underline{150 \text{ L}}$

TOTAL: 2080 L + 345 L + 52.5 L + 177 L + 1.08 L + 1.36 L + 150 L = 2806.9 L

A total of 2807 L of 0.5% aldrin will be required.

EXAMPLE B - Calculating a dilution rate

FORMULA - $Q = (C/S)-1 \times \frac{\text{specific gravity of concentrate}}{\text{specific gravity of diluent}}$

Q, C and S have the same meaning as in Example A

Useful facts - specific gravity of water = 1.0
- specific gravity of kerosene = 0.78

QUESTION 1:

Dilute an 80% dichlorvos concentrate (specific gravity = 1.4) to a concentration of 20% dichlorvos by diluting with kerosene.

Answer $Q = (C/S)-1 \times \frac{\text{specific gravity of concentrate}}{\text{specific gravity of diluent}}$

$Q = (80/20)-1 \times \frac{1.4}{0.78}$

$Q = (4-1) \times 1.79 = 5.37$

Q = 5.4 parts of kerosene to 1.0 part 80% dichlorovos

EXAMPLE C - Formulating Liquids on a weight-to-weight basis

FORMULA -

$$Q = \frac{S \times (\text{specific gravity of diluent}) \times A}{S \times (\text{specific gravity of diluent}) + (C-S)} \times \text{specific gravity of concentrate}$$

QUESTION 1:

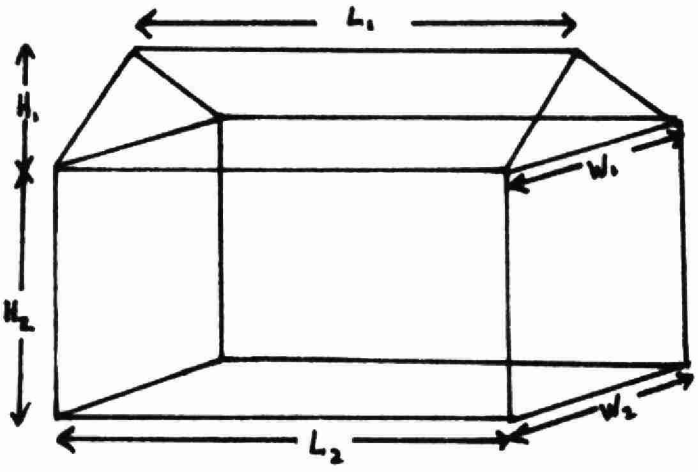
Prepare 25 litres of 2% malathion from a 50% malathion concentrate (specific gravity 1.5). Dilute with water (specific gravity = 1.0).

Answer $Q = \frac{2 \times (1) \times 25}{(2 \times 1) + (50 - 2) \times 1.5} = \frac{50}{74} = 0.67$ litres

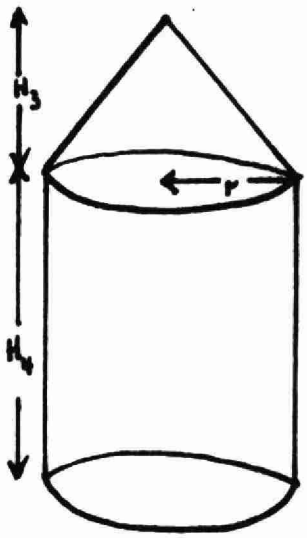
670 mL of 50% malathion is needed, i.e. add 670 mL to 24.33 litres of water to prepare 25 litres of 2% malathion.

EXAMPLE D - Determining the amount of fumigant to be applied to a sealed structure

The amount to be applied is given in kg/100 m^3. Therefore the cubic capacity is required. The following example will assist in determining the cubic capacity of various shapes.



STRUCTURE A



STRUCTURE B

Structure A = Volume = $\frac{W_1 \times H_1 \times L_1}{2} + W_2 \times H_2 \times L_2$

Structure B = Volume = $3.14 \times r^2 \times \frac{H_3}{3} + 3.14 \times r^2 \times H_4$

QUESTION 1:

A warehouse has a length of 30 m, a width of 25 m and rises to 3 m on each side, with a centre top ridge 4 m above the floor. Apply 2.5 kg of methyl bromide per 100 ml^3. How much methyl bromide will be required?

Answer

$V = L \times W \times H$
$V = 30 \times 25 \times 3$
$V = 2250\ m^3$

$V = \frac{L \times W \times H}{2}$

$V = \frac{30 \times 25 \times 1}{2}$

$V = 375\ m^3$

$2250 + 375 = 2625\ m^3$

$\frac{2.5\ kg}{100\ m^3} = \frac{x\ kg}{2625}$ $\quad x = \frac{2.5 \times 2625}{100}$

x = 65.6 (approximately 66 kg) of methyl bromide is required.